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Clinical Outcomes of Acute Abnormal Findings After Drug-Eluting Stent Implantation: Optical Coherence Tomography Analysis

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Background: Although acute abnormal findings (AAF) immediate after drug-eluting stent (DES) implantation such as stent malapposition, edge dissection, tissue protrusion and thrombus were frequently observed only by optical coherence tomography (OCT), relevant clinical implications have not yet to be evaluated systematically. We sought to evaluate long-term clinical outcomes of patients with AAF, compared with patients without AAF detected only by OCT after DES implantation.
Methods: A total of 157 patients undergoing OCT analysis immediate after DES implantation were enrolled and divided into 2 groups [AAF group (n=104) and non-AAF (n=53)] according to presence or absence of at least 1 OCT-defined AAF as followings; thrombus (n=37), malapposition (n=62), tissue protrusion (n=47) and edge dissection (n=33). The primary end point was MACE [major advanced cardiovascular events; all-cause death, non-fatal myocardial infarction (MI), target vessel revascularization (TVR), or stent thrombosis], which was compared between the both groups. Demographic, clinical, lesional and procedural data were also analyzed between two groups. Quantification analysis of AAF was performed to define the correlation between severity of AAF and MACE.
Results: Median follow-up duration was 24.7±8.2 months. Baseline characteristics were statistically similar in two groups. The rate of MACE was not significantly different between the two groups (8.7% for AAF vs. 3.8% for non-AAF, P=0.338), as well as each components of MACE; all-cause death (1.0% vs. 0%, p=0.448), nonfatal MI (1.0% vs. 1.9%, p=0.551), and TVR (2.9% vs. 0%, p=0.551). In Cox regression analysis, there was no significant relationship with AAF and MACE (HR=0.53, 95% CI, 0.096 to 2.923; p=0.467). The severity of AAF also was not associated with the incidence of MACE.
Conclusions: AAF immediate after DES implantation, such as edge dissection, tissue protrusion, malapposition and thrombus, detectable only on OCT, had no effect on long-term clinical outcomes , irrespective of its severity.

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Feasibility of Endomyocardial Imaging Using Optical Coherence Tomography For the Diagnosis of Myocardial Disease

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Background: Optical Coherence Tomography (OCT) is a high-resolution imaging modality that can provide cellular resolution structural information from biological tissue. Recent advances in OCT technology have demonstrated the clinical utility of this modality for the diagnosis of disease in various organs, most notably for retinopathy and atherosclerotic coronary disease. Here we demonstrate the feasibility of intracardiac OCT for the diagnosis of endomyocardial disease in human tissue.
Methods: Whole human hearts were obtained from the National Disease Research Interchange (NDRI) Tissue Bank within 48 hours of donor death. Tissue samples were taken from the RA, RV free wall, RV septum, LA, LV septum, and LV free wall. Ex-vivo OCT images from each tissue sample was obtained using a Thorlabs spectral domain OCT system (Newton, NJ USA), then sent to pathology for histologic diagnosis. OCT parameters analyzed were measured intensity (dB), attenuation coefficient (mm-1), and penetration depth (mm, distance to signal drop of 1/e). Images were grouped by histologic diagnosis, statistical difference between groups was examined using ANOVA analysis. Statistical Analysis performed in Prism 6, GraphPad.
Results: OCT images of myocardium had significant correlation with histopathologic diagnosis. OCT images of normal myocardium (n=16) had moderate signal intensity (51.8 +/- 2.3 dB), moderate attenuation (1.4 +/- 0.2 mm-1), and moderate penetration depth (0.28 +/- 0.04 mm); in comparison, fibrotic tissue (n=12, 46.69 +/- 4.37 dB, 2.16 +/-0.22 mm-1, 0.24 +/- 0.02 mm), adipose tissue (n=12, 42.03 +/- 1.13 dB, 0.88 +/- 0.18 mm-1, 0.32 +/- 0.18 mm), and collagen scar (n=8, 57.47 +/- 1.73 dB, 1.39 +/- 0.25 mm-1, 0.37 +/- 0.15 mm) had significantly different OCT parameter signatures, and could be differentiated from normal myocardium based on signal intensity alone (ANOVA, $p < 0.001$ for all groups).
Conclusions: Endomyocardial OCT imaging is able to differentiate clinically-relevant histologic features such as scar formation, fibrosis, and adipose tissue from normal myocardium due to unique OCT image signatures. This demonstrates the feasibility and utility of intracardiac OCT imaging for endomyocardial diagnosis.

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Integrated intravascular ultrasound (IVUS) optical coherence tomography (OCT) system for identifying thin-cap fibroatheroma

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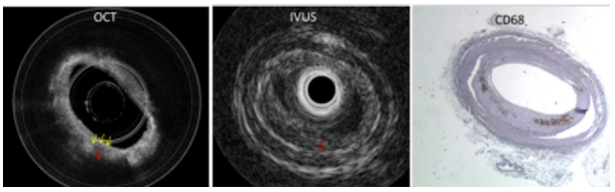
Background: It has been found that the majority of acute coronary events are caused by the rupture of a thin-cap fibroatheroma (TCFA), characterized by a large lipid or necrotic core with a relatively thin fibrous cap. Identifying vulnerable plaques and optimizing the therapy accordingly holds great promise for preventing rupture and life-threatening sequelae. Great progress has been made in developing a fully-integrated intravascular ultrasound (IVUS) optical coherence tomography (OCT) system and catheter. However, no TCFA image has been obtained by the integrated system. The integrated IVUS-OCT has potential to accurately identify TCFA and evaluating plaque vulnerability.
Methods: We imaged 175 cadaver coronary artery sites using our previously reported integrated IVUS-OCT system and 3.6F catheter with a high resolution of 8 μm and deep penetration depth of 4mm. Among all imaged sites, TCFA, thick cap fibroatheroma, and thin cap non-NCCL were found. Two cardiologists read the IVUS-OCT image pairs of plaque regions and classified each region as a TCFA or non-TCFA. They used the OCT images to measure the thickness of the fibrous cap and the IVUS image to evaluate the lipid pool size.
Results: TCFA were clearly visualized by the integrated IVUS-OCT system (see figure, yellow arrows denote the fibrous cap and "L" marks where the lipid pool is located). The cap thickness and the plaque burden size can be evaluated by OCT and IVUS, respectively.



Conclusions: The comprehensive ability of IVUS-OCT in identifying TCFA and quantifying plaque cap thickness is clearly shown here.

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Optical coherence tomography for the early detection of cardiac allograft vasculopathy after heart trasplant

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Background: Cardiac allograft vasculopathy (CAV) remains a major limitation for long term survival after heart trasplant (HT). Intravascular optical coherence tomography (OCT) is a novel catheter-based imaging modality that provides a higher spacial resolution in comparison with other conventional techniques like intravascular ultrasound. Our aim was to study the utility of the OCT for the early diagnosis and better understanding of the phisiophatology of CAV.
Methods: 35 cardiac trasplant patients underwent OCT in adittion to coronary angiography. Patients were stratified according to follow up time after HT: 0-1 year (y) (n= 16), 1-5 years (n=12), > 5 years (n=7). 10 patients followed another OCT control. Analysis included the measurement of the left anterior descending artery (LAD) intimal and medial thickness (IMT) and characterization of coronary plaques. IMT severity was based on Stanford classification.
Results: The patients mean age was 55,7±10,54 years . Intimal medial thickness increased from 0,40±0,27mm in group 0-1 years to 0,50± 0,33 in group 1-5 years and 0,58± 0,17mm in group >5 years . Plaque type analysis revealed predominantly lipidic plaques at earlier stages and fibrotic plaques at 3 years after HT. Calcified plaques were practically absent. Severe IMT was predominant in advance stages (5 of the total 10 cases in group >5 years), but was also present in an earlier follow up (2 in group 0-1 y, 3 in group 1-5 y). Angiographic evidence of coronary artery disease (4 cases, 11%) was only present at 5 or more years after HT. The mean time between the OCT detection of increased intimal thickness and angiographic coronary artery disease was 16,20 months.
Conclusions: The current study outlines the benefit of OCT performance for early detection of CAV after heart trasplant and detailed assesment of the wall morphogical changes of the coronary vessel. The benefit on clinical outcomes remain to be established.